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ABSTRACT

A guide is presented to the various uses of Comprehensive Achievement Monitoring (CAM), a computer-based instructional management system which provides relevant data on course objectives to elementary and secondary teachers and students after students are tested. Among the uses discussed are: student coupons, which list objectives on which the students are tested; a roster list for the teacher; a group summary report which may affect curriculum development and lesson plans; evaluation of new test forms; individual student evaluation; item analysis, mainly in connection with item or curriculum revision; the embedding of standardized test items in CAM tests; individualized education, using contracts; and the identification of core objectives or placement test items. (MH)

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TM010 00

CAM - HOW TO USE IT

BY

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HOPKINS INDEPENDENT SCHOOL DISTRICT 274

HOPKINS, MINNESOTA

APRIL, 1973

REVISED NOVEMBER, 1977

FORWARD

THE PURPOSE OF THIS MANUAL IS TO SHARE WITH TEACHERS SOME METHODS FOR USING CAM. THESE IDEAS ARE PRESENTED IN THE HOPE THAT THEY MAY SERVE AS A REFERENCE FOR INTEGRATING CAM INTO YOUR CLASSROOM.

WE THANK THE HOPKINS TEACHERS WHO GAVE THEIR TIME AND THEIR ENTHUSIASM IN DEVELOPING THESE MATERIALS AND HOPE YOU CAN PROFIT FROM THEIR WORK.

THIS MANUAL WAS WRITTEN AS A GUIDE. IT HAS BEEN ASSEMBLED IN LOOSE-LEAF FORM SO THAT NEW SUGGESTIONS MAY BE ADDED LATER. WHEN YOU DEVELOP NEW TECHNIQUES NOT DESCRIBED IN THE BOOK, WE HOPE YOU WILL SHARE THEM WITH US AND OTHERS.

GOOD LUCK AND SUCCESS

HOPKINS EVALUATION CENTER STAFF

APRIL, 1973

Editor's Note: Students's names are fictitious.

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THE STUDENT COUPON

THE STUDENT COUPON

The most immediate effect of CAM on the student is the student coupon. Teachers who have used CAM have found that the coupon is relatively useless alone. In order for the student to be able to read the coupon and then use the information from the coupon to help him study, he must have some back up reference material and activities that are coded to the objectives he will be seeing on his coupons. In the next few pages some examples of methods and materials for using the student coupon are given.

DOE JANE 2116 SECTION 1 MR. JONES 2
TEST ADM 4 · 11/23/77 FORM 41 WJ109
FRACTION CORRECT ON YES ITEMS IS 8/12

OBJ A INS	OBJ A INS	TEST ADM	FORM	PER COR TOTAL	PER COR YES	PER COR POST
110 + YES		1	11	33	66	100
116 + YES		2	21	40	75	100
132 + YES		3	32	46	62	75
216 + YES		4	41	50	67	50
230 - YES		5				
236 YES		6				
244 + YES		7				
258 + YES		8				
304 + YES		9				
318 - YES		10				
320 + YES		11				
404 - YES		12				
406 -		13				
412 -		14				
416 -		15				
504 +		16				
508 -		17				
510 -		18				
606 +		19				
612 -		20				
		21				
		22				
		23				
			CUM AVG	42	67	

Columns in the student's cumulative record may be either percent or fraction.

Different options for the categories printed in the cumulative record may be requested.

STUDENT OBJECTIVES

The first and most essential supplement to the coupon is to give each student in the class a list of coded objectives for the course (or part of the course) that is being CAM'ed. The one point that is stressed here for the student's sake is that the objectives be very specific and very readable. The format for the objectives varies, but the intent is that the student can refer to this list when he gets back a coupon and determine what sort of work he needs to do to improve his performance. Some examples of some student objectives that have been developed are given below.

0502 The student should change y to i when adding a suffix to a word ending in y preceded by a consonant.

21 The student will be able to describe how a presidential candidate is nominated and elected.

For help see: -McGrudes, Chapter 7
-Learning Packet #16
-Sound Filmstrip, "Elections"

1904 You can change a fraction with a denominator of a power of 10 to a decimal and a decimal to a fraction.

Example: $\frac{3}{100} = .\_\_\_\_\_$

Write the following as a fraction: .32 =

30 You can tell how a sharp, flat, or natural sign alters the note.

Example: What do these symbols do to the notes?

(1) ♮ (2) ♭ (3) ♯

TALLY SHEETS

Another tool teachers have found helpful in aiding student use of the coupon is the tally sheet. Initially the tally sheet was developed to motivate the student to look at his coupon and do some work with it. Basically a tally sheet is just a grid with the testing periods (1-20) printed across the top and the objective numbers listed down the left-hand side. Each time the student gets back a coupon he tallies his +'s and -'s in the column below the period of testing for that coupon. What is tallied varies among classrooms. Some teachers want the students to tally every objective that is tested, circling those objectives he should know--"yes" items. This way the student can read across a row for an objective and see that he is learning an objective, or knows an objective before it is taught. Other teachers are interested in tallying only those objectives that have a "yes" after them.

5th Grade Math — OBJECTIVE TALLY SHEET — NAME: Jane Doe

	PERIOD																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
608	-			-	+	+														
610			-	-	+	+														
612	-	-		+	+	+ +														
614		-	-	+	-	+ -														
700*	-		-		-	= =														
702*	+		+	-	+	+ +														
703			-		-	+														
704		-				+														
706				+																
708*	+	-				- +														

REVIEW MATERIALS

One of the more unique features of CAM is the retention data it provides. Teachers saw a need to make available review materials so that either an individual student or a group of students could go back and do additional work on material they are not remembering.

SLIDE TAPES

Slide tapes have been developed by a few teachers to serve as a means for an individual student to review material. The teacher has recorded a short mini-lesson on an objective or a group of objectives and made slides and usually some sort of worksheet to go along with the tape. The slide tape and any material the student needs is kept in the resource center or classroom and is coded to the objectives.

LEARNING PACKETS

On the same order of the slide tape is the learning packet. Learning packets have come about in varying fashion. Teachers have started from scratch by writing work packets covering material that students were frequently forgetting. Another way of putting these packets together is by pulling material from worksheets or other material already printed and coding it to the objectives. These materials are kept on file in the classroom or resource center so that students or teachers can easily pull from the bank of packets. When a student gets back a coupon and sees he is forgetting " yes" objectives he can quickly check on what type of work he needs.

REVIEW CARDS

The review cards are typed on index cards or card stock in the same way that the CAM test items are typed with the objective number on each card. The correct answer or solution is typed on the back of the card. These review cards can be kept on file so that a student on his own can pull items for objectives he needs work on or the teacher can pull items from this bank, overlay the cards and make up a work sheet for a group of students. Then by flipping the cards over the teacher has an answer sheet.

0112-1 The measure of one of two supplementary angles is 20 more than three times the measure of the other. What is the measure of the smaller angle?

Front of Card

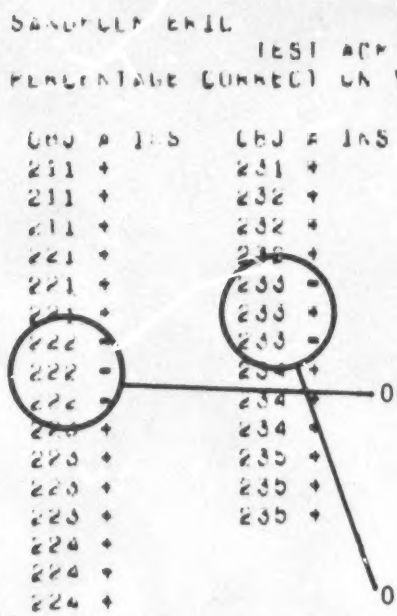
0112-1 x = smaller angle
$3x + 20$ = larger angle

$x + 3x + 20 = 180^{\circ}$
$x = 40^{\circ}$

Back of Card

STATIONS

As well as prescribing what type of review material a student needs to cover, the student coupon can be used to prescribe what new material a student will be covering. In the case of reading, teachers have set up stations around the room which are coded to an objective or set of objectives. These stations consist of a game, drill or practice for a small group of students. The coupon is used to select which station a student will go to next.



-OBJECTIVES-

0222 When the teacher says two words, you can tell when they do and do not end alike. You can name the sound you hear at the end.

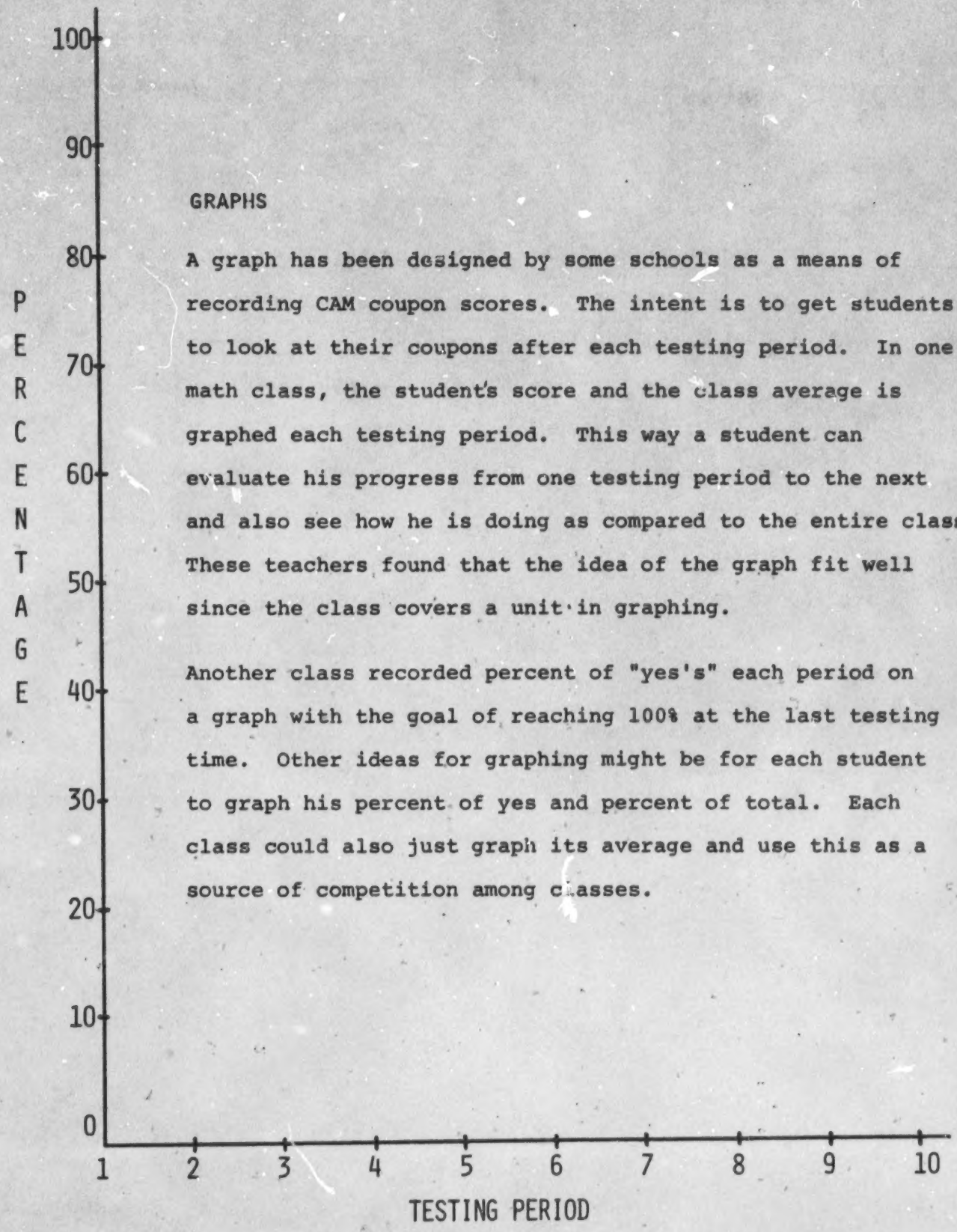
(bat-hut, six-sit)

0233 Root Words and Endings
You can find root words in words with endings.

(jumping, catches, runs)

Eric will be assigned to one of these stations:

	Name of Game	Maximum Playing
STATION 222 A STATION 222 B STATION 222 C	End-O (3 tapes)	8
STATION 222 D	Bingo-Bang	16
STATION 233 A	Puzzle-ment	1
STATION 233 B	Cut-Up	8



GRAPHS

A graph has been designed by some schools as a means of recording CAM coupon scores. The intent is to get students to look at their coupons after each testing period. In one math class, the student's score and the class average is graphed each testing period. This way a student can evaluate his progress from one testing period to the next and also see how he is doing as compared to the entire class. These teachers found that the idea of the graph fit well since the class covers a unit in graphing.

Another class recorded percent of "yes's" each period on a graph with the goal of reaching 100% at the last testing time. Other ideas for graphing might be for each student to graph his percent of yes and percent of total. Each class could also just graph its average and use this as a source of competition among classes.

SUPPLEMENTARY MATERIAL

Regardless of the resources a teacher has made available in the classroom to help the student, CAM testing will be of little value unless the teacher has first communicated the idea that CAM is an integral part of the course and is beneficial to both the teacher and the student.

To add to this philosophy the Evaluation Center has prepared a CAM booklet which briefly explains the coupon, objectives, and basic ideas behind CAM for elementary classes. A one page description of CAM testing and ways CAM can help the student has been written for junior and senior high classes.

One last note to maintain the idea of the value of CAM is to do everything possible to provide quick turn-around time. If for some reason a coupon doesn't run, a blank coupon has been printed so that a "temporary" coupon can be hand written and the student will get back a coupon with the rest of the class.

SECTION

TEST ADM FORM

PERCENTAGE CORRECT ON YES ITEMS IS

OBJ A INS	OBJ A INS	TEST ADM	FCT COR TOTAL	FCT COR YES
		1		
		2		
		3		
		4		
		5		
		6		
		7		
		8		
		9		
		10		
		11		
		12		
		13		
		14		
		15		
		16		
		17		
		18		
		19		
		20		
		21		
		22		
		23		

CUM AVG

CONFERENCE WITH PARENTS

Parent involvement is another side of CAM that is felt to be very important. The coupon can be useful for parent conferences. At a "parents night" the teachers have given the parents a copy of the objectives and the last coupon for the student. In some cases the students are present, and after the teacher explains how CAM fits into the program, the student can explain his coupon to his parents.

When the coupons are used for individual parent conferences, teachers have shown them the student's file of CAM coupons, the tally sheet and set of objectives.

The Evaluation Center has prepared a folder for parents that briefly explains the idea of objectives and the student coupon. The folder is designed to hold a copy of the student's objectives and the coupon.

Parents have received CAM well. In general, parents like the concept that teachers have defined objectives for their classes and are monitoring students performance on those objectives.

CONFERENCE WITH STUDENTS

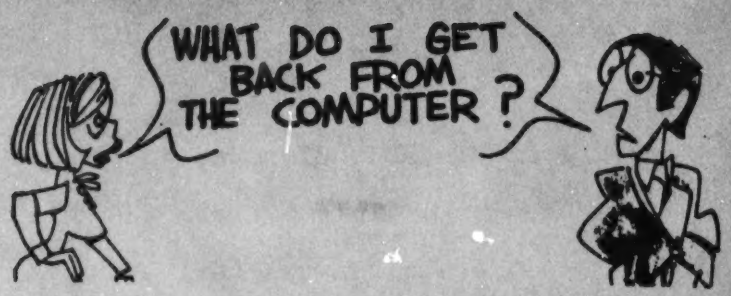
Coupons can serve as a good basis for a student conference. Writing comments on the coupons before they are handed back is one way of letting the student know that you feel the coupon is important and that you are looking at the results.

One other step might be to conference with the individual once a month for 5-10 minutes about his progress. At that time you could have the student show you his coupons, tally sheets, etc., and clear up any other problems he might be having.

TEACHER ROSTER LIST

TEACHER

ROSTER LIST



The teacher roster list is more commonly referred to as the class record. The information found on the roster list is the same as that found on the right side of the student coupon. It is simply a list of all the students in a class, their student numbers and their scores on all CAM tests: total, yes, and post (optional).

COMPREHENSIVE ACHIEVEMENT MONITORING - TEACHER SUMMARY REPORT

GEOMETRY LINDBERGH SECTION 1 STUART 1

NUMBER	NAME		CUM TOTAL	2	TEST 3	ADMINISTRATION PERIOD 4	5	6	7	8
1101.	ALWIN BAIRD	TOT	83	85	100	80	75	95	95	70
		YES	93	100	100	91	85	100	95	89
1102.	BESUNEN CYNTHIA	TOT	83	50	80	75	65	90	95	70
		YES	93	75	88	82	77	94	95	90
1103.	CASE TONI	TOT			70	50	80	70	90	40
		YES			71	60	79	76	90	60
1105.	DUNN KEVIN	TOT			55	45	45	30	50	40
		YES			71	62	36	35	50	44
1106.	FOX SHERRI	TOT	53	50	80	60	60			
		YES	62	88	82	64	64			
1107.	HARPER HEIDI	TOT	30	50	45	30	55			
		YES	30	63	41	30	57			
1108.	HELSETH JAMES	TOT	70	65	65	70	25	75	70	0
		YES	70	88	76	91	36	76	70	0
1109.	JAMISON KAREN	TOT	78	85	90	75	70	70	85	70
		YES	83	75	94	91	86	65	85	80
1110.	JENSEN RICHARD	TOT	60	70	70	70	65	50	60	0
		YES	60	63	65	66	71	59	60	0

OPTION - CUM TOTAL may begin average with any period

OPTION - Scores may be reported as either a percent or fraction

GRADES

The CUM TOTAL option was put in the program as an aid for using CAM in grading. This average can start with any testing period. If grades are given quarterly and four CAM tests were given during the first quarter, periods 1, 2, 3, 4 would be averaged. For the second quarter, if three CAM tests were given, the average could start with period 5, averaging periods 5, 6, and 7, to give a CUM TOTAL for just that quarter's work.

Another case related to CAM in grading is allowing students to option out of the final exam. One teacher puts the CAM CUM TOTAL averages on a curve. If the student prefers, he can then use his average of "yes" scores on CAM tests for his final test grade rather than take the final exam.

CHECK ON INDIVIDUAL

The teacher roster list is the only CAM report the teacher gets back on individual students. This list can be of help in spotting trends in a student's performance.

			CUM TOTAL	1	2	3	4	5
1234	Bunker, Archie	TOT	48	25	45	60	60	50
		YES	65	100	88	67	61	50

Archie's scores on "yes" are slowly going down. This may be an indication that Archie is forgetting old material or that he isn't learning the new material being presented. Whatever the case, it would be a good opportunity to talk to Archie and look at his coupons with him to see where he is having trouble.

TEACHER ROSTER LIST IN AN INDIVIDUALIZED CLASS

In an individualized course the teacher roster list is a record of each student's progress. On the teacher roster list for an individualized course, if test administration period means contract (i.e. period 1 = contract 1), the teacher can quickly see which students are falling behind in their contracts. The teacher can also spot the students that are way ahead of the rest of the class and plan enrichment or new work for them.

COMPREHENSIVE ACHIEVEMENT MONITORING - TEACHER SUMMARY REPORT

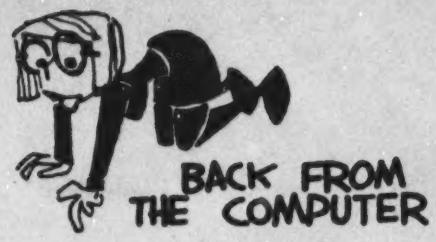
MATH 4 - KATHERINE CURREN SECTION 1 FENSTAD 2

NUMBER	NAME		CUM TOTAL	TEST ADMINISTRATION PERIOD 1	2	3	4	5	6
4212,	MOLENAAR MICHAEL	TOT	95	100	100	85	0	0	0
		YES	95	100	100	85	0	0	0
	* Michael (#4212) is on contract 3.								
4214,	NOVAK JULIE	TOT	93	100	100	80	0	0	0
		YES	93	100	100	80	0	0	0
4216,	POMERLEAU JOEL	TOT	94	95	100	95	85	0	0
		YES	94	95	100	95	85	0	0
4220,	RYNDERS STEVE	TOT	95	95	95	95	0	0	0
		YES	95	95	95	95	0	0	0
4221,	SCHAFER GREG	TOT	96	95	95	95	95	100	0
		YES	96	95	95	95	95	100	0
	* Greg (#4221) is on contract 5.								
4223,	SMITH LORENE	TOT	88	85	100	80	0	0	0
		YES	88	85	100	80	0	0	0
4225,	SMOLAK STEPHANIE	TOT	70	70	0	0	0	0	0
		YES	70	70	0	0	0	0	0
4235,	AHLERS DAVID	TOT	88	85	0	95	85	0	0
		YES	88	85	0	95	85	0	0

* David (#4235) has skipped contract 2.

GROUP SUMMARY

GROUP SUMMARY REPORT



CAM's effect on the curriculum comes from the group summary report. The effect is not as immediate as the coupon on the student, since it summarizes groups of students on an objective or group of objectives. Decisions from group summary data are based on trends or patterns of a group of students over a number of testing periods. It takes three to four testing periods for the data to split into pre, post, and retention data.

"QUESTION GROUP"
ANY GROUPING OF OBJECTIVES OR TEST ITEMS

COMPREHENSIVE ACHIEVEMENT MONITORING - GROUP SUMMARY REPORT

MATH

MR. JONES

"STUDENT GROUP"
ANY GROUPING OF STUDENTS

QUESTION GROUP		TEST ADMINISTRATION PERIOD 1	2	3	4	5	6
OBJECTIVE 2201	PRE	31	29	0	0	0	0
PCT COR	POST	0	0	32	31	32	38
	RETN	0	0	0	0	0	0
	PRE	20	20	0	0	0	0
NUM RESP	POST	0	0	20	20	20	20
	RETN	0	0	0	0	0	0
OBJECTIVE 2203	PRE	27	25	0	0	0	0
PCT COR	POST	0	0	75	70	75	80
	RETN	0	0	0	0	0	0
	PRE	56	56	0	0	0	0
NUM RESP	POST	0	0	56	56	56	56
	RETN	0	0	0	0	0	0
UNIT 22	PRE	28	26	0	0	0	0
PCT COR	POST	0	0	65	60	65	70
	RETN	0	0	0	0	0	0
	PRE	76	76	0	0	0	0
NUM RESP	POST	0	0	76	76	76	76
	RETN	0	0	0	0	0	0
ALL OBJECTIVES	PRE	25	26	28	32	28	30
PCT COR	POST	0	70	75	80	75	77
	RETN	0	0	0	68	72	75
	PRE	520	480	480	400	300	200
NUM RESP	POST	0	140	140	167	167	166
	RETN	0	0	0	162	189	176

70% OF THE 76 RESPONSES TO QUESTIONS ON UNIT 22 WERE ANSWERED CORRECTLY

LESSON PLANS DURING THE SCHOOL YEAR

During a school year the group summary report can be a help in lesson planning for an individual teacher or a teaching team. Teachers may decide to go back and review objectives or units that are slowly dropping down once they have become retention.

		1	2	3	4	5	6	7	8
UNIT 3	PRE	20	25	0	0	0	0	0	0
PCT COR	POST	0	0	80	75	75	0	0	0
	RETN	0	0	0	0	0	65	60	50
	PRE	80	80	0	0	0	0	0	0
NUM RESP	POST	0	0	80	80	80	0	0	0
	RETN	0	0	0	0	0	80	80	80

Also, if teachers have the opportunity to spend some time developing review materials, the group summary report can be a timesaver for planning which objectives need review material.

In addition to the retention information, pretest data can also supply some clues for lesson plans. If pretest scores are much higher than the teachers expect them to be, they might make the decision to shorten the length of time spent on that unit or isolate and work with the group of students that don't understand the unit. The teachers might possibly decide to skip the unit completely.

		1	2	3	4	5	6	7	8
UNIT 4	PRE	60	70	70	65				
PCT COR	POST	0	0	0	0				
	RETN	0	0	0	0				
	PRE	80	80	80	80				
NUM RESP	POST	0	0	0	0				
	RETN	0	0	0	0				

Post test data can also provide the teachers with needed information. If a teacher has been covering a unit and cannot decide if the class is ready to go on to the next unit, the group summary report can give the teacher the information to make the decision to move on to the next topic.

		1	2	3	4	5	6	7	8
UNIT 5	PRE	25	30	0	0	0	0	0	
PCT COR	POST	0	0	85	90	95	94	95	
	RETN	0	0	0	0	0	0	0	
	PRE	80	80	0	0	0	0	0	
NUM RESP	POST	0	0	80	80	80	80	80	
	RETN	0	0	0	0	0	0	0	

CURRICULUM PLANNING AT THE END OF A SCHOOL YEAR

By looking at the complete group summary report for the entire class at the end of a school year, teachers can analyze the effect of the curriculum on the students. If contracts are used in the course, this data can pinpoint those contracts that aren't doing the job. (Post and retention scores are not as high as desired.)

A team of teachers might also look at their individual group summary reports and analyze the effect of different methods of instruction used. Looking at the data this way can promote a valuable exchange of methods and ideas for the teaching team.

The group summary report can be a useful tool for deciding which parts of the curriculum need the most work. Valuable teacher time can be saved by using the group summary report as a guide to curriculum revision.

ACTIVITIES

In much the same way that materials were designed to motivate use of the coupon, teachers have tried different activities to motivate use of the group summary data. An algebra II team leader sent the note below to his team members as a summary of CAM results. CAM TID-BITS in this case was used to report on a comparison between two school years.

CAM TID-BITS

THROUGH UNIT IV

I. Retention

	1976-77	1975-76
Unit I	70%	71%
Unit II	75%	61%

REVIEW SHEET MUST A PAID OFF

Atta boy sweet Clyde!

Unit III	79%	78%

II. Post Test Results for Unit IV

70%	54%

GREAT JOB GANG

III. Miscellaneous

A. We are averaging 5% to 6% higher than School B

B. We are in the planning stage of comparing our students with Park and Ramsey.

C. Best job (whatever that means).

1. Unit I	Retention	Teacher I	80%
2. Unit II	"	Teacher I	90% WOW!!!
3. Unit III	"	Teacher II	84%
4. Unit IV	Post test	Teacher III	75%

D. Objective 122 results have been incorrectly recorded all year.

IV. Up coming: Unit V created problems in 1970-71
Be on guard!!!

OTHER ACTIVITIES

Students, too, can be involved in the use of Group Summary Data. Since the summary can be printed for any grouping of students, a teaching team might want to try competition between boys and girls , sections, teachers, etc.

Group Summary Data can also be a useful tool in presenting your program to parents or principals. Some teachers have made the group summary available at open house at their school to support their curriculum and classroom structure. It is printed proof that students are learning.

At the end of a school year a teaching can have a good view of the entire years work through the group summary data. This data can be presented as evidence in support of curriculum writing.

TEST FORM EVALUATION

In addition to a regular CAM run (coupons, teacher roster list and group summary data), a fourth type of printout can be processed. Test form evaluation is generally run when new test forms are being taken for the first time. Teachers that have used the test form evaluation have found it very helpful in proofreading test forms. By looking at the total percent correct a teaching team can also see how " parallel " the test forms are (whether one certain test form is consistently more difficult than another).

Reading 7 - West Junior High

Test Form 21

Question Number	Objective Number	Number of Responses	Percent Correct	A	B	C	D	E	NR
1	102	40	80	0	80	8	5	8	0
2	306	40	95	0	5	0	0	95	0
3	208	40	65	5	5	65	0	10	15
4	202	40	15	70	5	15	5	5	0
5	304	40	85	85	8	0	0	8	0
6	806	40	30	30	20	25	20	5	0
7	110	40	90	3	3	0	90	0	5
8	204	40	75	20	0	5	0	75	0
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
20	104	40	75	75	10	5	5	5	0
TOTAL		800	70						

Correct answer should be "A" not "C"

Test Form 22

TOTAL 780 73

Form 23 looks more difficult than forms 21 and 22.

Test Form 23

TOTAL 820 59

STUDENT ANALYSIS

STUDENT ANALYSIS

Number of questions from unit 2 when it was pre-test.

Percent answered correctly.

CAM STUDENT STATUS REPORT FOR, MATH 4 - WEST ELEMENTARY

1119 SAWYER, TOM

UNIT	PRE-INSTRUCTION NUM	PRE-INSTRUCTION PER	POST-INSTRUCTION NUM	POST-INSTRUCTION PER	RETENTION NUM	RETENTION PER
1	0	0	5	80	9	89
2	4	50	6	66	10	80
3	6	33	8	25	9	44
4	7	57	6	83	0	0
5	9	44	0	0	0	0
TOTAL	26	50	25	60	28	72

UNIT 4 PERCENTAGES

Tom must have just completed unit 4 since there is no retention information.

Tom knew 50% of the questions when they were pre-test, 60% when the material was post-test, 72% on retention.

PARENT CONFERENCES

The main use of the Student Analysis has been in parent conferences. The total percentage correct on pre-test, post-test, and retention material is used to show the parents the growth of the child throughout the school year. It will also show the parent in an individualized program how many units, packets or contracts the student has completed. Student analysis information is particularly helpful with students that are slow-learners. It will compare the child with himself not with the rest of the group. Even if the child's percentages may only be 20% pre, 40% post and 40% retention, the information does show progress and that learning is taking place.

STUDENT CONFERENCES

The Student Analysis can be used in student conferences the same way it is used in parent conferences. With students, you could, however, look more closely at progress across units not only progress on the total learning. It may point out units in which the child should do more work.

PERMANENT RECORD

The Student Analysis would serve as a good record which could follow the child from year to year. This type of student record would give a teacher a better picture of the child's progress to the time she has contact with him - how many units he has covered and how well he did on those units.

ITEM ANALYSIS

The Item Analysis is used mainly in item revision or curriculum revision. If you have an objective-item book for a course, we have found it helpful to write the item analysis in the book next to the item. The advantages of this are: (1) The data are easier to read for the teacher. (2) They can make revisions in the items in the book and will not write on the item cards.

An item book example is included below:

222 Given a problem in adding 2, 3, or 4 amounts of money whose sum is less than $100.00, the student is able to accurately find the total and write it in correct form.

Whole objective: pre = 57, post - 75, retn - 90

Compute: $1.25
2.50
+ 4.75

Pre	Post	Retn
0	97	90

Pre	Post	Retn		
0	0	0	A.	$7.75
0	3	10	B.	$7.50
0	97	90	(C)	$8.50
0	0	0	D.	$8.25

Compute: $22.45
+ 53.00

Pre	Post	Retn
80	100	100

Pre	Post	Retn		
0	0	0	A.	$52.45
5	0	0	B.	$77.77
5	0	0	C.	$76.00
90	100	100	(D)	$75.45

ITEM ANALYSIS

Item No. 1 for Objective 0202

25 students responded to the item before instruction. 23% answered correctly.

Shows how the students responded to an item immediately after instruction.

Shows which % of students chose answer A,1=79%; B,2=0%; C,3=2%; D,4=5%; E,5=14%.

OBJ	ITEM	PRE-INSTRUCTION NUM	PER	1	2	3	4	5	POST-INSTRUCTION NUM	PER	1	2	3	4	5	RETENTION NUM	PER	1	2	3	4	5
	0202 01	25	23	23	18	16	15	28	38	75	75	3	5	7	10	54	79	79	00	2	5	14
	0202 02	26	75	3	4	75	C	16	28	80	3	5	80	0	12	50	80	4	4	80	0	12
202	OBJ AVG	51	54						66	78						104	80					

54% of the students answered questions keyed to objective 202 correctly at pre-test; 78% at post; 80% at retention.

VI-2

LET'S SEE-
IF THE LAST ANSWER WAS "B," THEN THIS ONE MUST BE "C."
THAT MEANS THE NEXT ONE SHOULD BE "E"-
& OH, YES LONG ONES ARE ALWAYS THE RIGHT ANSWERS.

When looking at an item analysis, the teacher should be aware of certain trends or patterns. The decisions that are made from the data will vary in different situations. Below are listed some sample results and possible decisions at which a teacher could arrive.

Data Show: Students are not choosing a listed response. The question is multiple choice.

	PRE					POST					RETN				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
20101	25	30	0	30	15	10	80	0	5	5	8	83	0	4	4

Example: If the students did not choose response C when it was pre-test, post-test or retention, response C could be changed to be more of a distractor. If we are assuming that on pre-test material the students are at a guessing level, all responses should be receiving the same percentages. If there are responses that the students are not choosing, they should be examined and perhaps replaced.

Decisions: Replace the choice with another more logical choice.

Data show: Students are responding differently to the items within an objective.

Example: Objective 208 has two items that are receiving the results listed below.

	Pre % Correct	Post % Correct	Retention % Correct
20801	20	40	40
20802	60	85	90

The teacher should then look at the items and decide if they are testing the same objective or actually two different objectives. If they are testing the same objective, item 2 could have an obvious answer.

Decisions:

1. Break objective into two objectives.
2. Change responses of item 2 to be better distractors.
3. Change wording of question.
4. The questions are of two different levels of difficulty. You expected these results. Leave the questions as they are.
5. Try to change instruction to raise post-test results on item 20801.

Data show: The students show little or no improvement on an item.

Example: Item 30602 has the scores below.

	Pre	Post	Retn
30602	20	23	18

You should first look at the distractors (the incorrect responses). Does one of those responses draw a high percent of the student responses? If so, what is there about the response that causes the student to choose it? If all responses are receiving about equal percentages, then the teacher should look at the item and check vocabulary, appropriateness to objective, correct answer, etc. A pattern of percentage as shown above doesn't, however, mean the item should be changed. The percentages could be very valid percentages, thereby indicating the students had trouble with that

objective and a new approach to teaching the objective should be developed.

Decisions:

1. Change responses.
2. Change item (wording, etc.).
3. Leave item as it is. Change teaching approach.

Data show: Pre-test scores are significantly higher than post or retention.

Example: Students have responded to item 23002 in the following way.

	Pre	Post	Retn
23002	70	30	35

The teacher should first check the answer that is keyed correctly to see if it is the correct answer. The teacher should also look at the response that received the highest percentage and analyze why the students would choose that answer. Another possibility is a word or diagram in the correct answer that draws attention to it when the item is pre-test. After the students understand the meaning of the word or skill, the other responses act more as distractors and the percentage correct drops.

Decisions:

1. Reword choices.
2. Look at teaching approach.

The chart on the next two pages shows some examples of decisions that have been made by an algebra team using item analysis data.

UNIT 4 DECISION ANALYSIS

Objective	Item Analysis Data Pre	Post	Ret	Teacher Comments	Instructional Decisions
402-Be able to use the laws of exponents to write products of algebraic expressions when the exponents are real numbers.	42	81	73	Items 4025 and 4026 do not test this objective.	Change responses to items 4025 & 4026. (no change in correct responses)
404-Be able to use the laws of exponents to write the quotient of algebraic expressions when exponents are real numbers.	45	63	71	OK	Stress difference between - $(2x)^2$ and $2x^2$
406-Given an expression in radical form with rational numbers, write it in exponential form.	30	71	65	OK	
408-Given an expression in rational exponential form, write it in radical form.	37	38	39	Little overall learning. Check item 4082	Rewrite item 4082. Stress problems using radical form of binomials. e.g. $(a + b)^{1/3}$
410-Given an expression involving real number bases and rational exponents, write it in simplest form.	36	54	59	OK	Stress "simplest form" in teaching.
412-Given two or more rational algebraic expressions be able to write their product and express the answer in lowest terms (assume all denominators are non-zero).	20	56	43	Item 4123 too difficult.	Change 4123 question.

VI-6

Objective	Item Analysis Data Pre	Post	Ret	Teacher Comments	Instructional Decisions
414-Given two or more rational algebraic expressions be able to write their quotients and express the answer in lowest terms (assume all denominators are non-zero).	35	45	40	Item 4142 too complex.	Change item 4142. Stress factoring difference of 2 cubes.
416-Given two or more rational algebraic expressions be able to write their sums and express the answer in lowest terms (assume all denominators are non-zero).	29	40	41	Item 4162 too complex.	Rewrite.
418-Given two or more rational algebraic expressions be able to write their differences and express the answer in lowest terms. (Assume all denominators are non-zero.)	25	48	53	Item 4182 ambiguous. Same for 4181.	Rewrite. Rewrite.
420-Given a complex fraction be able to simplify this fraction.	39	22	22	Items 4201 and 4203 too complex.	Rewrite question.
OVERALL	34	54	58		

Correct response unchanged.

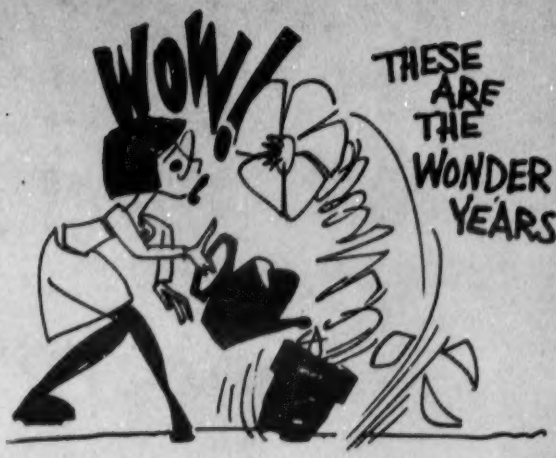
CURRICULUM REVISION

Since the item analysis not only gives results by item but also summarizes results by objective and unit, it can be used very effectively in curriculum revision. The teachers can easily focus in on objectives that have high pre-test scores.

Below is documentation of one team's use of item analysis with curriculum. When working on the item analysis in the summer they made notes that can be used the next year in teaching the concepts.

OBJECTIVE NUMBER	COMMENTS	DECISIONS
0212	retention down -	Call to attention of rest of teaching team.
0218	O.K.	
0220	Items O.K.	Must stess slope of horizontal and vertical lines.
0222	Poor results. Items O.K.	Emphasize def. and "zero slope" vs. "no slope."
0224	Items O.K.	Lindbergh unify teaching approach.
0226	Items O.K. but poor response.	More practice - Compare results with other teacher for methodology.
0228	Change all responses to either Ax + By = C or y= mx + b form.	Also change objective 226, 228, and 230 to be written in both standard forms and slope-intercept.

OTHER APPLICATIONS



STANDARDIZED TESTS AND STATE ASSESSMENT

One unique application of CAM is the notion of embedding standardized test items in CAM tests. By doing this the students do not have to take the whole standardized test (only about 8 items) and a class period does not have to be set aside to give the standardized test. The students also get information that is relevant to them since the standardized test item must be keyed to objectives.

A study was done by breaking a 40 point standardized test into five CAM forms, 8 questions on each form. The forms were 20 point tests consisting of 12 CAM test items and 8 standardized test items. The students were given the CAM tests and then were administered the whole standardized test within a 3 day period. The mean score for the sampling was within one point of the mean score for the whole test.

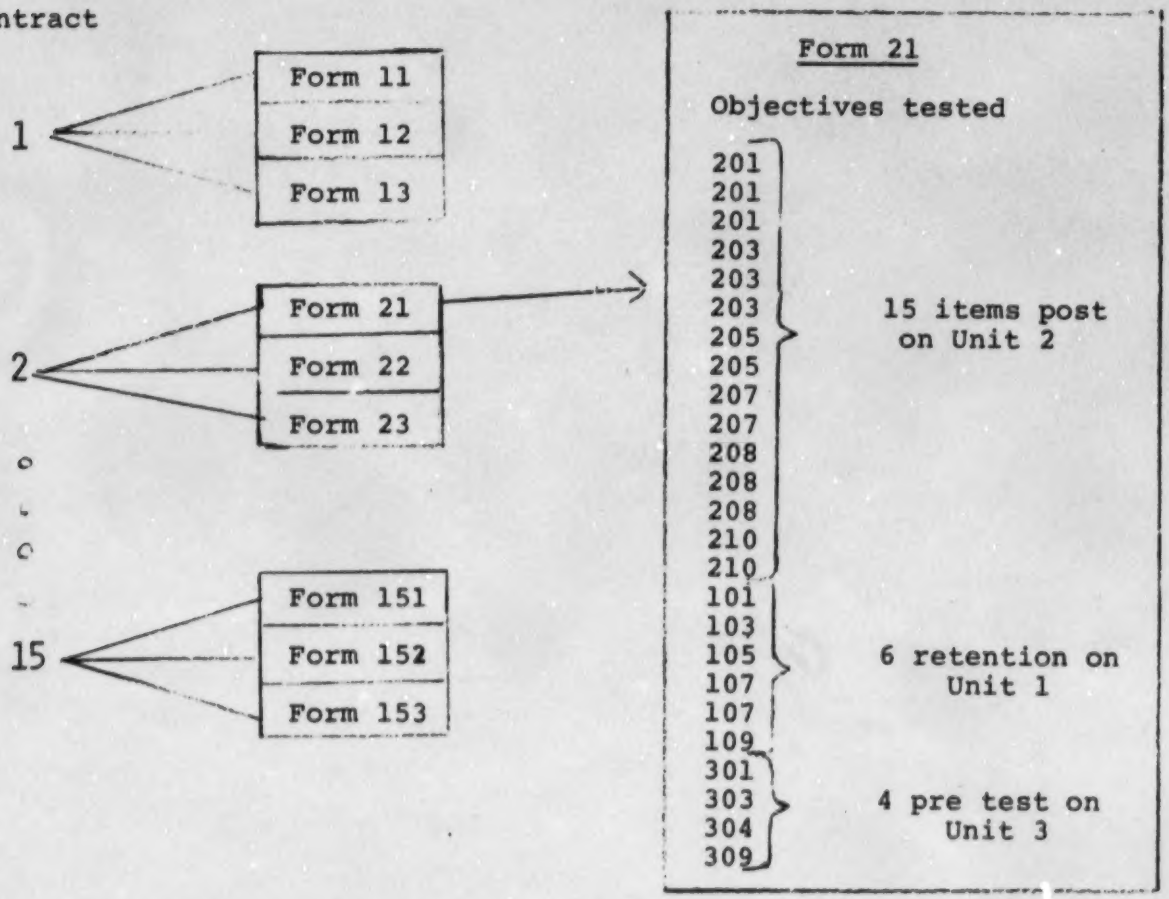
The same technique could be used with State Assessment objectives and items.

INDIVIDUALIZED INSTRUCTION WITH CONTRACT APPRAOCH

In education today, individualized instruction is playing a more important role in the classroom. Therefore we have been looking for ways to make the CAM model complement the individualization. One of the main drawbacks of individualized instruction is the record keeping. We have used CAM as a way of assisting the teacher with her records as well as giving them information to make decisions. Two different models are explained.

MODEL ONE :

The instruction is designed around 15 contracts. These contracts are in a sequential order. The CAM test the student takes is the test he takes after he completes the contract. We have developed 3 forms of a test for every contract. The forms have 25 items, 15 post-test items (on contract just completed) , 6 retention (on previous contracts) , 4 pre (on the next contract). i.e. A form for contract 6 will be numbered form 6-1, 6-2, or 6-3 and will have 15 questions from unit 6, 6 questions from units 1-5, and 4 questions from unit 7.



A student in the course would start off with a test on contract 1. If he passes that test, the teacher will look at the four pre-test items on contract 2 to determine if he should take a test on contract 3 or do work in contract 2. If he does well on the four items, he will take a test on 2 to see if he can test out of the contract.

The period number on a CAM test means contract numbers (i.e., period 1 = contract 1, period 6 = contract 6). Since the period number means contract number, we have students taking tests from period 1 to period 15.

The tests are part free response and part multiple choice. Student checkers immediately grade the tests and give the students the results. The Evaluation Center picks up the tests once a week and runs them through the computer. The teacher roster list serves as a grade book for the teacher by showing which contract (period) the student is working on and how he has done on all the past tests.

MODEL TWO:

Again the students go through a series of 20 contracts or packets. The students take teacher made tests at the end of the packet to determine whether they continue into the next contract. CAM tests are given every 2 weeks to the whole group. The forms are assigned in accordance to the student's position in the contracts. The CAM tests are designed to test "retention" and "pre" since the teacher-made tests cover the post items. The test results are used in conferences with the students to decide what they need to review and what material they do not have to cover.

CORE OBJECTIVE TEST OR PLACEMENT TESTS

Many of the courses that have been working with objectives for some time have started to identify core objectives -- objectives that all teachers should be emphasizing in their classroom. From the list of core objectives for a course we have made core objective tests. These are given three times a year -- at the beginning of the school year, the middle and in June. This gives the teacher a check on how their students are doing before the year begins, what they still need work on in the middle of the year and their final growth.

A placement test is also being designed for the beginning of the year. The teachers will give these tests (anywhere from 45-180 questions) to give themselves an idea in which group or on which contract the students should start working.

CLASSIFYING ITEMS AND OBJECTIVES

Don Erpelding, a physics teacher at Eisenhower, found when explaining the CAM coupon to the students, that he was having difficulty because the questions coded to an objective were actually questions of different levels of difficulty. On the next page is a report he wrote explaining his project and the possible outcome he hopes to see.

Inservice Project Report - Don Erpelding

Purpose: The reason why I undertook this project was to do a critical analysis of the type of questions being asked on the physics CAM tests and to then compare the results achieved by students on the various tests to the type of questions being asked.

Project Description: Each of the 340 test items in the physics CAM test bank was categorized into one of three groups. The "level one" group being of the knowledge or comprehension type question. The "level two" group included questions involving application and problem solving. The "level three" or highest level questions included questions that could be classified as analysis, synthesis, or evaluation type questions. All 340 test items will then be renumbered and grouped into one of these three groups so that item analysis of the three levels of questions or problems can also be accomplished.

Outcome Evaluation: From now on whenever a student gets back the results on a CAM test, he will be able to tell immediately what type of question he is having the most difficulty with as well as which objectives he needs additional work on. It may also be possible to "weight" level three type questions more heavily than lower level questions.

In the analysis of how the entire class is doing on various units of instruction, a number of possibilities exist as to possible outcomes of this project.

a. We should be able to tell what to spend more time on! i.e., problem solving, comprehension, etc.

b. By varying modes of instruction we will be able to tell which mode is most effective for each of the 3 levels of questions.

c. We will be able to tell where retention of instruction is the greatest (i.e., at what level of questions).

d. We will be able to compare growth in all 3 levels on the pre and post tests.

e. Many other possibilities.